SUPPLEMENT.

The Mining Journal,

RAILWAY AND COMMERCIAL GAZETTE:

FORMING A COMPLETE RECORD OF THE PROCEEDINGS OF ALL PUBLIC COMPANIES.

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GOVERNMENT INSPECTION OF COAL MINES.

THE INSPECTORS' REPORTS.

The reports of the several Inspectors for 1869, which have just been published, are slightly less favourable than those of the preceding year, so far as regards coal mines, but in the ironstone mines there has been a very satisfactory diminution in the number of casualties. The occurrence of several calamitous explosions in the Wigan and North Wales districts has made the deaths for each separate accident more numerous than in the preceding year; yet, looking at all the figures, they are less unsatisfactory than at first appears. There were four more explosions in 1869 than in 1868, but the deaths resulting increased from 154 to 257. Accidents from falls of roof and sides still continue excessively high, apparently owing chiefly to the carelessness of the men themselves. Shaft accidents remain about ordinary, and the miscellaneous accidents underground and at surface have been more numerous. In 1868 one life was sacrificed for every 103,429 tons raised, whilst last year only 99,777 tons were raised for each life lost, so that there has been no improvement in that respect. Again, there was one death in 1869 for each 309 men employed, whilst in the preceding year there was but one death to each 343 men employed. We subjoin our usual tabulated summary, which will permit of the several classes of accident being compared:—

COAL MINES—1868.

Names of districts.	Separate Accidents.					Deaths Resulting.				
	Explosions of Fire-damp.	Falls of Roof and Coal and Sides of Working.	In shafts.	Miscellaneous, underground and at surface	Total.	Explosions of Fire-damp.	Falls of Roof and Coal and Sides of Working.	In shafts.	Miscellaneous, underground and at surface.	Total.
Durham, Northumberland, Cumberland districts..	3	28	16	20	67	3	30	16	20	69
Southern division of Durham ..	1	35	10	38	84	1	36	10	40	87
North and East Lancashire....	4	33	6	18	61	5	33	8	19	65
West Lancashire & North Wales	12	58	18	38	126	116	62	18	41	237
Yorkshire district	5	35	11	26	77	6	36	11	27	80
Derbyshire, Nottinghamshire, Leicestershire, and Warwickshire.....	1	24	9	24	58	1	24	9	26	60
North Staffordshire, Cheshire, and Shropshire	7	28	8	14	57	9	28	10	14	61
South Staffordshire & Worcester.	2	55	16	17	90	3	58	21	22	104
South West Div. (parts of Monmouth, Gloucester, Glamorgan, Brecon, and Devon....	1	43	5	10	59	1	44	5	12	61
North Wales district	3	49	8	40	100	4	49	8	43	104
South district of Scotland....	1	24	8	8	41	1	25	9	8	43
North district of Scotland ..	4	20	7	9	40	4	20	7	9	40
Total.....	44	432	122	262	860	154	445	132	281	1011

COAL MINES—1869.

Durham, Northumberland, Cumberland district }	2	26	14	30	72	6	28	14	32	80
Southern division of Durham ..	1	30	6	37	74	2	31	6	40	79
North and East Lancashire....	3	39	11	21	74	3	39	12	22	76
West Lancashire and North Wales	8	43	20	30	101	128	45	20	41	234
Yorkshire district.....	1	38	6	17	62	1	41	7	20	69
Derbyshire, Nottinghamshire, Leicestershire, and Warwickshire	5	31	11	23	70	6	31	12	29	78
North Staffordshire, Cheshire, and Shropshire	3	25	7	10	45	7	25	7	11	50
South Staffordshire & Worcester	5	63	20	8	96	6	68	22	8	104
South West Div. (parts of Monmouth, Glo'ster, Glamorgan, Brecon, and Devon)	6	37	—	9	51	23	37	—	8	68
North Wales district	9	62	14	30	115	70	63	15	12	181
South district of Scotland....	1	29	8	17	55	1	30	8	9	58
North district of Scotland ..	4	28	6	1	39	4	28	6	1	39
Total.....	48	451	123	232	854	257	466	129	264	1116

IRONSTONE MINES—1868.

North Lancashire & North Wales	—	—	—	—	—	—	—	—	—	—
Yorkshire district.....	—	—	—	—	—	—	—	—	—	—
Derby, Notts., Leic., & Warwick	—	2	4	1	7	—	2	4	1	7
North Staff., Cheshire, & Shrop.	2	10	4	5	21	2	10	4	6	22
South Staffordshire & Worcester	—	6	3	2	11	—	6	3	2	11
South Western Division.....	—	13	—	3	16	—	13	—	3	16
North Wales district	—	6	2	—	8	—	6	2	—	8
South district of Scotland....	—	—	—	1	1	—	—	—	1	1
North district of Scotland ..	—	2	1	1	4	—	2	1	1	4
Total.....	2	39	14	13	68	2	39	14	14	69

IRONSTONE MINES—1869.

North Durham	—	2	—	—	2	—	2	—	—	2
Yorkshire district.....	—	3	2	1	6	—	3	2	1	6
Derby, Notts., Leic., & Warwick	—	8	2	2	12	—	8	2	2	12
North Staff., Cheshire, & Shrop.	—	6	3	5	14	—	6	3	5	14
South Staffordshire & Worcester	—	4	2	2	8	—	4	2	2	8
South-Western Division.....	—	3	—	—	3	—	3	—	—	3
North Wales district	—	1	—	—	1	—	1	—	—	1
South district of Scotland....	—	2	3	3	8	—	2	3	3	8
North district of Scotland ..										
Total.....	—	29	12	13	54	—	29	12	13	54

With regard to the number of male coal miners employed in and about the coal mines of Great Britain, the number of fatal accidents and lives lost, the quantity of coal raised, and the proportion of accidents and lives lost to the number of persons employed, and to the quantity of coal raised in the year, all necessary information will be obtained from the subjoined table, The importance of discipline becomes every day more apparent. The patented contrivances do not appear in practice to be productive of any saving of life. Mr. Atkinson's estimate, based upon experience, of the value of improved (?) safety-lamps is anything but re-assuring; and Mr. Wm. Alexander thinks that among the last important shaft accidents in his district the cage falling away in the shaft, and with a safety apparatus such as White and Grant's, perhaps one of the best that has been introduced, he felt satisfied that the disengaging catch had been the cause of accident. Referring to the management of mines, Mr. Wynne believes that to prevent accidents a better class of men should be employed in the superintendence of collieries—"men who look upon those accidents which are preventable as in some measure discreditable to themselves, and reflecting on their management." He is of opinion that if the owner were made responsible for the negligence of his manager none but competent men would be employed. He thinks, however, that no increase in the number of Government Inspectors is required. To show that periodical inspection, without constant care on the part of the resident manager, cannot be looked to as a preventive of accidents, Mr. Wynne quotes the fire-damp explosion at Woodshutts Colliery, brought about by disobedience of orders and lax discipline, though under the management of one of the most able viewers in England, Mr. J. T. Woodhouse. The two other fatal explosions were caused by the carelessness of the workers. Mr. Wynne attributes much of the loss from falls of coal and roof, and explosions of gunpowder, to the abuse of powder, and irregular propping after blasting, which is now the almost universal means of getting the coal. Extracts from the several reports are subjoined:—

1868.

Names of districts.	As computed by each Inspector for his own district.		Per separate fatal accident.	No. employed per life lost.	Tons of coal raised per separate fatal accident.	Tons of coal raised per life lost.	Number of collieries.
	Males employed.	Tons coal raised.					
Northumberland, Cumberland, & N. Durham	32,000	11,400,000	477	463	170,149	165,217	175
South Durham.....	37,000	15,300,000	440	425	182,142	175,862	171
North & East Lancashire	26,360	7,053,000	432	405	115,623	108,508	292
West Lancashire and North Wales.....	32,000	7,600,000	254	135	60,317	32,067	208
Yorkshire	37,000	9,705,000	480	462	126,039	121,312	459
Derby, Nottingham, Leicester, & Warwick	28,000	7,699,000	483	466	132,741	128,317	195
N. Stafford, Cheshire, and Shropshire	21,000	6,000,000	368	344	105,263	98,360	225
S. Stafford & Worcester..	28,000	9,900,000	311	269	110,000	95,192	550
Monmouth, Gloucester, Somerset, and Devon	26,000	6,200,000	441	426	105,084	101,639	201
South Wales	29,300	9,000,000	293	281	90,000	86,538	300
Totals—England & Wales	296,660	89,857,000					2776
East Scotland	29,000	8,456,084	707	674	206,246	196,653	254
West Scotland	21,160	6,253,875	504	504	156,346	156,346	203
Totals, Scotland	50,160	14,709,959					457
Totals & averages, England, Wales, Scotland	346,820	104,566,959	403	343	121,589	103,429	3262

1869.

Northumberland, Cumland, & Nth. Durham	32,000	11,660,000	444	400	161,944	145,750	183
South Durham.....	37,800	15,636,000	511	478	211,297	197,924	163
North & East Lancashire	26,190	7,020,000	354	345	94,865	92,368	297
West Lancashire and North Wales.....	32,449	8,018,939	321	139	79,395	34,269	200
Yorkshire	36,000	10,893,500	581	522	175,702	157,877	413
Derby, Nottingham, Leicester, & Warwick.	28,500	8,100,000	407	365	115,714	103,846	200
Nth. Stafford, Cheshire, and Shropshire	21,000	6,200,000	466	420	137,777	124,000	225
S. Stafford & Worcester..	28,500	10,408,000	296	274	108,416	100,076	550
Monmouth, Gloucester, Somerset, & Devon..	26,000	6,250,000	509	382	122,549	91,912	210
South Wales	29,000	9,180,000	252	160	79,826	50,718	300
Totals—England & Wales	297,439	93,366,439					2741
East Scotland	28,000	8,500,000	509	483	154,545	146,552	270
West Scotland	20,007	6,137,043	513	513	157,360	157,360	195
Totals, Scotland	48,007	14,637,043					465
Totals & averages, England, Wales, Scotland	345,446	108,003,482	405	309	126,468	96,777	3206

The above tables really embrace all the general statistics contained in the reports, and a large amount of information as to the precise circumstances under which the several accidents happened is given in the reports for each district. As usual, the reports supply many valuable suggestions and observations of a practical character, those embodied in the subjoined extracts being among the number:—

Safety-Lamps.—In previous reports, Mr. Atkinson mentioned a series of experiments that have been conducted by a committee of the Northern Institute of Mining Engineers, with the view of ascertaining the relative degree of safety or danger appertaining to so-called safety-lamps when exposed to rapid currents of fire-damp, and as he has been desired by Messrs. Hann and Son to give expression to his views as to the relative merits of one or both of their patent lamps, and as he believes that they have also applied to the Home Secretary, asking for some competent persons to be appointed to enquire into and report upon the merits of one or both of their patent lamps, it may perhaps not be out of place to state that he found one of their lamps very "petted in burning," a slight motion from travelling extinguishing the light. The engineer of a very large and fiery mine has told Mr. Atkinson since that he obtained a dozen of these lamps in order to give them a trial, but that before venturing to use them in the mine he had them tested in a small gasometer of the class described in Mr. Atkinson's annual report for 1867, and that as the gas was exploded by one of the lamps he did not, of course, deem it either safe or prudent to allow them to be used underground, but returned them. The simple test alluded to is, he thinks, specially worthy of more extensive adoption than it has hitherto obtained, and again commends it to the notice of those who have the management of fiery collieries. Mr. Atkinson has reason to suppose that Messrs. Hann and Son have from time to time made alterations, which may be improvements, in their patent lamps, but as several other proposed new lamps are in the field, he has not, up to the present time, had leisure to examine into the minute details of all the suggested improvements made in the various new lamps that are being attempted to be brought out, and, but from the repeated applications of Messrs. Hann and Son, he should not have thought of their lamps as calling for special notice.

How to Lay Tram-rails in Collieries.—The deaths on inclines are stated by Mr. Wynne to be on the increase, which is to some extent owing to the want of care in laying the rails, and as a preventive he would suggest that all sleepers should be prepared with gouged-out spaces for the rails to fall into, and then if a nail sprang the rail would still keep in its place. Owing to the fact that the tubs travel at a much greater velocity on inclines than on roads, increased care should be bestowed upon such inclines, but, owing to the temporary nature of some of them, the rails are often laid in the roughest manner; the result is that the tubs run off several times in a day, and lead to lamentable accidents.

How to Descend into Foul Gas in Shafts.—In connection with one calamity in his district, Mr. Baker says it appeared that several days previous to the accident an air-tight scaffold had been constructed in one of the shafts, for the purpose of extinguishing an underground fire, and Mr. Hipkins, believing that sufficient time had elapsed to accomplish this, requested one of his workmen, named Briscoe, to go and remove a portion of the scaffold, which he partially succeeded in doing, but the state of the ascending air was so foul that he was compelled to leave the work, and hasten to the surface. After several unsuccessful attempts to open the scaffold a quantity of air cloth trows was lowered to ventilate the shaft. Briscoe again descended, and on reaching the scaffold immediately gave the signal to be drawn up the shaft; and when he was within 11 or 12 yards of the top he, owing to the presence of carbonic acid gas, became insensible, relaxed his hold, and fell out of the horse down the shaft. The owner, Mr. Hipkins, at once descended, and reached Briscoe, but he unfortunately fell from the effects of the deadly atmosphere, and died side by side with his servant, whilst in the performance of an heroic act to effect his rescue. Strange to relate, however, neither of the victims took a light of any kind with them. Had they done so the dangerous condition of the shaft would have been apparent, and their lives spared; or if they had been tied in the horse and quickly raised (as the men who afterwards recovered their bodies were) they might possibly have escaped a death so terrible and unexpected.

Connection of Storms and Explosions.—In two previous reports Mr. Brough made mention of certain natural occurrences witnessed after the autumnal equinox in the years 1866, 1867, and 1868, and he suggested that as some of our annual groups of accident were coincident in time, that they might have relation the one with the other. The probability of any such sort of connection may be very remote indeed, or really and truly it may not exist at all. Nevertheless, this periodicity of earthquake, storm, and explosion in coal mines having again manifested itself in the fall of the year 1869, it becomes impossible that such recurring phenomena should escape observation and remark. The investigations of the present century have, to a certain extent, taught us that during and after earthquake the undulation of land waves stretch far and wide. These may be said to be periods when the solid earth is thrilled through to vast distances from the centre of initial action. That this seismic energy in any way affects remote mining operations is a question only to be determined by future observation, spread over succeeding years, and there is no doubt but that patient investigation will be given to the subject. But, though we be affected, or not affected, by annual vibratory action and hurricane, it is still best for us, and the only true approach to safety, to keep our collieries surcharged with such supplies of fresh air as will "mix up with and render harmless" any amount of gases that may be met with from any cause or influence, whether inherent in the coal, or in the locality of the mine, or even in consequence of disturbances as far distant as the tropical belt itself.

Evil of Pumping and Winding with One Engine.—Referring to surface accidents, Mr. Moore reports that three persons were killed by the engine getting out of gear with the winding drum, and the rope "running amain." These accidents will always happen so long as geared engines are made to do the double duty of pumping and winding by the present arrangement. Close attention to the matter has convinced him that it is the arrangement that is at fault, and that the most experienced and cautious engineman fails to guard against accidents with them. There are many contrivances, more or less effective, for keeping the wheels in gear, but, so far as he knows, none are so good as having separate engines for pumping and winding, so that the drum is always in gear. This arrangement is becoming extensively used, and it is his constant practice to recommend its adoption. The other accidents were mainly caused by the fault of the sufferers themselves, and do not call for special remark.

Inspectors' Duties—Reports on Suspected Mines.—More inspection than Mr. Higson was able to make might have worked up discipline, though he cannot say it would have prevented a single explosion, unless an Inspector had been present at the time of the casualty, or shortly before it happened. Notwithstanding what has been said to the contrary, scores of mines have been inspected during the year wherein no accident has happened, or to which his attention has been directed. The cause of every casualty has been carefully investigated at the coroner's enquiry, and by thorough inspection of the mines in question. His time has been fully occupied out of doors, and his indoor work has been done nearly altogether beyond working hours, in the hope of satisfying every class. It seems, however, his efforts to do so have not been completely successful. As the state of a mine may become so quickly disarranged, and frequently as soon put right, it would in many instances be an act of injustice to publish the result of every inspection, which some people would like to be done.

Mr. Wynne is aware that the opinion that an increase of the number of Government Inspectors would tend greatly to the lessening of the number of accidents has been disseminated to a great extent among miners, and has no doubt made a considerable impression on their minds; but, with all respect for the views of others, he cannot subscribe to such an opinion, his idea of the duties of an Inspector being to see that proper rules are in force at every colliery within his district, and to take care that every infraction of general or special rules brought under his notice is not allowed to pass without meeting with the punishment it is his bounden duty to enforce, without fear or favour.

Result of Inspection.—So many statements having recently been made with regard to inspection, Mr. Evans thinks it would be well to refer to the published statistics, and ascertain the facts before coming to a conclusion as to whether it is doing the work intended by the Legislature or not. The present Act came into operation late in the year 1855. The figures in the following table are for 1856, the first whole year after the passing of the Act, and 1868, the last year for which the general statistics are published. From the comparison it will be seen that, although the quantity of coal raised has increased 63 per cent., yet the number of deaths remains about the same.

Date.	Coal worked.	Deaths.	Tons of coal raised per death.
1856	64,000,000	1012	63,241
1868	104,500,000	1011	103,429

It must also be remembered that 14 years ago the coal mines generally were limited in area, of shallow depth, and, consequently, ought to have been worked with far less danger and a smaller proportion of deaths than those of the present time, when, owing to the exhaustion of the seams near the outcrops in every field they are of much greater depth, and, therefore, also of much greater extent. He believes that inspection has produced good practical results, and is continuing so to do. But if the public imagine that inspection, however much it may be extended, will put an end to fatal accidents in mines they are greatly deceived, for all that can be done is to reduce them to the lowest possible point. The appointment of many more Inspectors would have the effect of shifting the responsibility from the owners and agents to the Government, at least, in some degree; and if this effect is once produced then, in his opinion, mines will not be so well managed, and more accidents will result.

Boiler Insurance.—Referring to the boiler explosion at Sherburn House Colliery, Mr. Atkinson feels it unnecessary to enter into details, as there was nothing more in the case than what pointed to the old cause in the form of boilers being used until the iron is deteriorated in quality by long exposure to the hot air and gases of the boiler fires, and finally become further weakened by the process of planing, to get the rivet holes of the new plates used to repair them, until they are no longer capable of withstanding the ordinary working pressure. He adds that he thinks it highly desirable that colliery boilers should not only be placed under the supervision of one or other of the several boiler inspection companies, but that the boilers should be insured, in order, so far, to ensure efficient inspection on the part of the agents and workmen of such companies. The faulty parts of steam-boilers is a speciality with them, and their great experience naturally enables them to detect and report defects of a dangerous character.

Inexperienced Miners.—The employment of men unaccustomed to mining is, Mr. Evans thinks, often attended with increased danger, and sometimes with fatal results. It is, however, difficult to keep such persons out of the mines, especially when we consider the rapid progress this trade has made throughout the district; and the high rate of colliers' wages induces men to leave trades which are stagnant, and in which the prospect of improvement is distant.

Loading at Mid-Workings.—The shaft accidents, six in number in Mr. Alexander's district, have been 30 per cent. fewer than the average of the last 14 years. This is satisfactory, and such as might have been anticipated, considering that covered cages working into guides are now nearly universally employed. Putting on or "cleeking" coal at "mid-workings" in the open shaft has been discouraged; in a few cases safety appliances have been constructed, with the view of giving greater security to the persons engaged at such openings; and at the surface moveable fences, to act in connection with the cages, are being gradually introduced to prevent persons from falling unwittingly into shafts. These are a few of the leading improvements connected with shafts, which have been slowly extending for the last 30 years. They have so far proved efficacious, and it is to a further extension and perfecting of these arrangements and contrivances that we may still look for a continued diminution of this class of accidents. In the new Bill for the regulation of mines several important general rules were proposed. In addition to these he suggests that another general rule should be added, prohibiting the placing of "tubs" upon cages in open shafts at mid-workings, unless under certain conditions which would provide for the safety of the persons engaged at such works. This objectionable system is principally confined to shafts where two or more seams exist, and are being worked. But by introducing "cross-cut" mines, as is often done, and are being worked. But by introducing "cross-cut" mines, as is often done, and the roadways might be concentrated at the shaft to one or two seams, and in such cases a cage might be arranged to wind from each seam; or in another way, by continuing the present system of mid-working, and become bound to

introduce a well-contrived appliance which would in all conditions, in the absence of the cage, act as a fence upon the shaft. An illustration of such an apparatus was given in his report for 1867, and it is satisfactory to find that it is still in operation, and is being introduced at other works. Such a regulation would not restrict colliery operations generally, nor add to the cost of production, but it would at once put a stop to persons falling down shafts from "mid-workings," which in the aggregate form a large number annually, and, strictly speaking, are preventable, and should not happen.

VALUE OF SAFETY APPLIANCES.—Safety apparatuses in connection with winding in shafts, the object of which is to save life in case of the winding-rope breaking or getting disengaged from the cage, were introduced into his district upwards of eighteen years ago; and though they apparently were calculated to protect the lives of those who required to be lowered and raised in shafts, it is doubtful if much real good resulted from the use of them. It appeared to Mr. ALEXANDER at the time that there was a general desire to employ them if trustworthy, and could be proved to be of real benefit. However, for some years they have been comparatively out of use, and he knows of only one colliery where they are at present in operation. Considering that there are upwards of 300 shafts in his district, where persons are lowered and raised daily, it is creditable to those engaged in looking after the details of this particular branch of management, and must be satisfactory for them to know that for the last seven years no fatal accident has happened about the collieries by the breakage of a winding-rope. As such appliances have been frequently recommended by gentlemen anxious no doubt to diminish the risks of the persons employed in mines, he thinks it proper to add, speaking for himself, that he would not care to see steps taken to enforce the use of any such contrivance. Bearing in mind the facts stated, it might be prudent in the meantime to let well alone, and rather rely upon well-made and carefully looked after winding-machinery, attended to by steady and judiciously appointed enginemen. The best arranged apparatus requires to be constantly looked after, so as to keep it in a proper state of repair. Among the last important occurrences of the kind which took place here, by the cage falling away in the shaft, and with a safety-apparatus, known as "White and Grant's," perhaps one of the best which has been introduced, he felt satisfied that the disengaging catch had been the cause of accident.

THE DOUBLE SHAFT SYSTEM.—During the past five years' experience of the double shaft system, the question has frequently been put as to what is the most suitable position in which to place the shafts to each other. Regarding this there is a variety of opinions; but Mr. ALEXANDER believes that the shafts should be some distance apart; at least, a great deal more than 10 ft. The form of shaft long peculiar to this district does not appear to have been affected by the late enactment. And what under the old, or single shaft system, would have been a single shaft of 12 or 14 ft. by 6 ft., is now two, *a b*, fig. 1, each 6 ft. by 7 ft., or thereby, and placed 10 feet apart. He is satisfied that this arrangement is not the best for ventilating purposes, in consequence of the action of the cage upon the air in the upcast shaft. Fig. 2 exhibits an arrangement not much more costly, but incomparably superior for the collieries of this district. The winding-pit, A, is arranged on the single-shaft system as before; and the outlet shaft, situated to the "rise" at B, convenient to the winding-machinery, C, which may, when required, be taken advantage of, is used wholly as an upcast. By this system the operations at the pit bottom and at the surface are more concentrated, and conducted with greater safety and economy, and the upcast, free from the objectionable retarding movement of the cage, admits of a more effective and satisfactory system of ventilation being carried out.

Fig. 1.

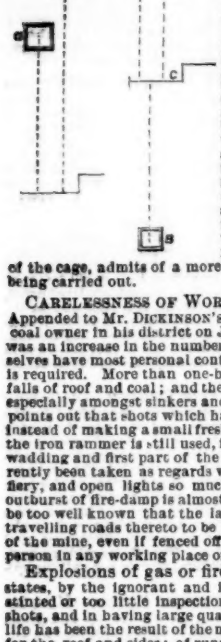

Fig. 2.

CARELESSNESS OF WORKMEN—DANGEROUS USE OF POWDER.—Appended to Mr. DICKINSON'S report is a circular which he forwarded to each coal owner in his district on Jan. 17, 1870, in which he states that in 1869 there was an increase in the number of those accidents over which the miners themselves have most personal control, which appears to show that better discipline is required. More than one-half of the whole of the fatal accidents are from falls of roof and coal; and there is still a serious continuance of fatal accidents, especially amongst sinkers and metal men, from the careless use of powder. He points out that shots which have missed fire are still attempted to be undrilled, instead of making a small fresh shot near enough to fire both charges; and that the iron rammer is still used, instead of a wooden or a copper one, in getting the wadding and first part of the ramming fairly bedded. Greater care has apparently been taken as regards ventilation; but where so many of the mines are fiery, and open lights so much preferred, the least mistake or a small sudden outburst of fire-damp is almost sure to cause an explosion. It cannot, therefore, be too well known that the law still requires not only the working places and travelling roads thereto to be adequately ventilated, but that every other part of the mine, even if fenced off, must be in such a state as not to endanger a person in any working place or travelling road.

Explosions of gas or fire-damp have been promoted, Mr. HIGSON states, by the ignorant and incautious use of gunpowder below ground, by stinted or too little inspection of the working and other places before firing shots, and in having large quantities of gunpowder in the mine. Great loss of life has been the result of the men themselves neglecting to fix adequate supports for the roof and sides; of running trains and tubs at an unnecessary pace, regardless of persons being in the way; of travelling on engine and self-acting planes when the machinery was in motion; of approaching the eye and sides of the pit incautiously; of attempting to extinguish standing fires in mines with water; and of carelessly riding up and down the pit or shaft, and getting in and out of the cage. From these causes 101 fatal accidents have happened, and 234 persons have been killed within the year.

EXTENSION OF GOVERNMENT INSPECTION.—Those who have no knowledge whatever of coal mines, but who are acquainted in some measure with the character and conduct of uneducated workpeople, can have no difficulty in understanding how such misadventures occur. Much as the question of more inspection has been raised and may be desirable, Mr. HIGSON has thought that many of the casualties herein reported might have happened while he was in the mine. Often has he found men working in great danger from want of their places being propped and spragged, when props and sprags in abundance were lying out of use within a few yards. This is a state of things inspection can never reach, nor is it desirable to attempt it; the men should first do all they can, and then if necessary ask for help. Many lives have been lost in shaft and mines in which a man might live without fear of danger; in which ropes are always removed in due time, shafts walled and fitted up with proper guides, cages covered, and timber supplied in abundance; still lives are frequently lost through carelessness and by misadventures. There are, however, many works in which there is only an imaginary line between safety and danger, and there are times which occur in exhausting a mine when all works are more or less in such a state. This is occasioned by the very nature of the occupation. For working under such circumstances negligent, careless, or even ordinary men are totally unfitted. It is, therefore, requisite in such places to employ none but competent men; but even that cannot be accomplished, as the supply is far below the demand. Underlookers and firemen are not, as a rule, sufficiently educated or trained to the strict observance of duty, though he must confess there are many really first-rate men among them. He finds a great absence of proper discipline below ground. Orders, when given, are not carried out, and are frequently altogether disregarded by the men. In making an examination before igniting shots firemen content themselves by examining one place only—namely, that in which the shot has to be fired—instead of examining those on every side. Any underground officer who issues instructions should never neglect to see at once that they are properly obeyed. It is not possible to estimate the value of discipline too highly; it is a most important element of success. The men, both young and old, should have this constantly impressed upon them; the special rules should be read and explained to them regularly; and the conduct of the under officers as to sobriety and punctual attendance to duty should be constantly observed and properly regulated. Accidents it will be found occur from a variety of causes. Although considerably more lives are lost during the average of years by falls in the mines than by explosions of gas, it is only from the last-mentioned cause that public excitement and public sympathy are strongly exhibited. It may be thought that men can guard themselves against danger from any cause but explosion of gas, but that is not really the case, as in many instances the men and the firemen are alone responsible for an explosion. As to other casualties, many are misadventures, and many purely accidental occurrences inseparable from the occupation. The former sweeps away life like as it were by a whirlwind; by the latter it is gradually frittered away. The owner of a mine may provide good ventilation and make all proper provisions for safety, but unless the underlookers, firemen, and workpeople themselves well and punctually perform their part it is of no avail. As most coal mines emit gas, its uncertain issue from the mine itself and from the goaf is only the natural result of mining; it should be constantly looked for, and an adequate quantity of air circulated through and to the end of every place in the mine sufficient to dilute and render harmless gas to any extent on its first appearance. A connection between one place and another should be made at intervals in fiery mines of not more than 20 yards, and brattice should be kept in a perfect state.

SUDDEN OUTBURSTS OF GAS.—The cause of an explosion is often said to have been the result of an outburst of gas. During an extensive practice of nearly 40 years Mr. HIGSON has not known many such occurrences, and he is of opinion that they are few and far between. Explosions take place, as a rule, from neglecting to observe the regulations, and by firing shots (blasting) in a vitiated atmosphere, or near a quantity of impounded or accumulated gas, which becomes ignited by the flame. Shots frequently blow out, particularly when the resistance has not been lessened by cutting or nicking the side, and produce great flame. He has known the flame of a blown out shot extend 80 yards from the shot hole. Such extent of flame would ignite gas in an adjoining place, and, perhaps, the rarefaction would liberate it from its confinement. He has not been able to attribute the cause of some of the explosions of the year to anything but the absence of ordinary precaution, and it is much to be regretted that the parties blameable escaped by the loss of their lives legal punishment. It must, nevertheless, be acknowledged that their conduct had the justification of general practice in the district.

BREAKING DOWN COAL WITHOUT GUNPOWDER.—In former times men were compelled to hole and cut the coal, and get it down afterwards with the hammer and wedge. Mr. HIGSON has not seen a hammer or wedge used in a mine for some time. They are now things of the past. Gunpowder has been instituted as a substitute; and it is now used more or less in most mines. Whether this is done on the score of economy, or the men prefer the less laborious system, is uncertain; at many places, however, they have the control. When mines were being worked at shallow depths the use of gunpowder was less objectionable than now. At an increased depth there is an increase of the issue of gas, and at 800 yards deep blasting is found to be altogether impracticable. It is argued, and undoubtedly upon good premises, that if there is no gas there can be no explosion, and therefore it is safe to blast. But gas will lie in places ventilation cannot always reach, and the fact of a shot producing great flame, the effect of which in places where the heat is excessive and the mine dusty has never been thoroughly examined. It is, however, manifest that in such places blasting should be strictly prohibited. This is the opinion of the men also, but in some parts of the district the coal cannot be got without the use of gunpowder, and this is the case in those mines the produce of which is of the least value, and machinery has not yet been found as a substitute which is practicable to operate.

ADEQUATE VENTILATION.—Preparations for good ventilation have now been made at most mines in Mr. HIGSON'S district; but the system of causing an adequate current to flow through every working place is not generally practised. He sometimes finds the cold enough to starve the men to death near the down-cast pit, on the inbye air-course, and the heat in the working places so great as to be unbearable. At other times he has found all the air in the mine flowing in one current, and too much in quantity for the men to bear. This encourages them to seek relief by opening doors and brattice to keep the wind off them, and he frequently finds places being exhausted alongside of a goaf with a good current of air passing close by, but not the least quantity reaching where the man works. These things show most clearly the incapacity of the management, and mark the class of men who permit them to exist.

ABSENCE OF SUPERIOR OFFICERS IN MINES.—The management of mines is too often left entirely to underlookers, who may be quite equal to the discharge of their own laborious duties, but altogether unfit for all things. That proper persons should in all mines be employed to manage or view, and be compelled to go regularly through the workings, there can now be no doubt, and owners should well consider this matter without being enforced. It is manifest that unless competent persons of acknowledged ability be employed serious casualties will from time to time occur, and equally clear that although such men might not prevent them altogether, they would lessen their number. It is scarcely right to ask Government to do that which persons can do for themselves, but until they are compelled many will neglect to do it. It can hardly be expected that the present staff of Inspectors can inspect and regulate all things: 100 accidents a year will occupy 100 days of the Inspector's time at the least; then, again, to examine all workings would take years of uninterrupted labour. With so many painful casualties before him, which if an Inspector had only been expected might not have occurred, he is of opinion that if more inspection be considered necessary and desirable each Inspector should have a few assistants, and they should be young men of education and promise, capable of discovering any breach of law; that they should be distributed over and located in the mining districts, where they could obtain information from the men of the state of the mines, and communicate all important matters to the Inspectors. Such appointments need not be a great charge on the Treasury, and by their good conduct they should be considered eligible for the office of Inspector. There are mines through which a man advanced in years would not be able to travel. In inspecting such mines young men would be of great service. Then, again, he has never heard of a mine being dangerous until a casualty transpires, and it is only rarely that any communication of danger reaches him from any quarter. He has always to look for it himself. That much mischief is done by the irregular working of mines, which sooner or later produces fatal results, all must admit. This was properly stated in the House of Commons by Mr. Lancaster on the second reading of the new Inspection Bill. Mines are taken upon lease at high royalties, and subject to very large fixed rents, payable before the mine can be properly opened. This drives the lessees to work the coal for immediate returns, by which damages to the pit and roads to such an extent are frequently the result that they become a continual source of danger. Mr. HIGSON thinks proper plans of lessees proposed undertaking should be submitted and approved at the outset, or before operations begin. If the workings of a mine have been badly set out and unskilfully conducted the best supervision will fail to prevent casualties. Success, therefore, mainly depends on the scheme being first well considered at the beginning, and carefully carried out afterwards.

RESULTS OF CARELESS MANAGEMENT.—Mr. HIGSON can produce no better proof that lives are lost almost daily through inefficient management and carelessness of the men than that they happen in mines in which such disasters ought never to occur. They are not so frequent in those mines in which the risk from fire-damp, bad roof, and many other obstacles is more conspicuous, in addition to their lying at an extreme depth, where the atmosphere becomes intensely heated. The heat of the Arley, or lower mine, in the middle coal field is greater than that of any other mine in the coal field. On being recovered at the depth of 810 yards at the Rose Bridge Colliery the thermometer stood at 93° in a confined place. It is hardly to be supposed that the heat would increase much below this point, while there is strong evidence to show it would be very much reduced on approaching the grit measures below. At one-fourth the depth of any other mine the heat of the Arley Mine is by far the greatest. As the Trias and Permian measures produce little or no heat, but are generally cold, and sometimes wet, it seems practicable to recover the coal even at the depth of 1200 or 1500 yards under Trias and Permian deposits.

EDUCATION.—Although much has been done for the education of boys of tender years, that of girls in Mr. HIGSON'S district is still unsatisfactory. The Act for them makes no provisions. This may be an oversight, but as girls are extensively employed above ground it should, and may be, easily rectified. It will, he fears, be an act of injustice to prohibit boys working below ground under the age of 12 years. They may by the time they arrive at the age of 10 years acquire sufficient learning to enable them by attending school a few hours a week for some time afterwards to obtain a good education. The opportunity of doing so did not exist a few years ago, but the provisions for that object are now nearly ample. To keep young persons from work till they are 12 years of age will, he fears, create an objection to labour which through life they may never be able to overcome. It would drive them from mining to seek other occupations. At that age many will never be able to work in thin mines of 14 to 16 in. thick. In Belgium both boys and girls are permitted to work below ground at the age of 10 years, provided they are able to read and write.

The subject of primary education becomes easier to deal with the better it is understood, and those difficulties in connection with it, which a few years ago were thought insuperable, are now scarcely named when the question is discussed. The miners almost to a man may be said to be in favour of compulsory secular education, being convinced of the folly of keeping boys from work, unless by doing so their education is to be secured, and in those cases where parents are fully occupied as bread-winners he does not see how such education is generally to be ensured unless its acquisition and furnishing is made compulsory by law. Experience has convinced Mr. WYNNE that but little (if any) inconvenience would be felt in his district if no boys were allowed to work in mines under the age of 12 years, and whatever restrictions are imposed after that age the half-time system is not, in his opinion, the most advisable way of preventing the partially educated boy from lapsing into the ignorant man. Under the present arrangement it would be better for boys to work alternate days than that the working of the pit should be interfered with by changing the staff of boys in the middle of a day's work. Much is now being done for shortening the hours of labour of the working man, and if miners have the disposition to make, and the strength to enforce, resolutions and rules for shortening their hours of labour in the pit, surely the boys ought not to be placed under less favourable conditions. There are very few districts where the want of schools is a matter of complaint, the owners and occupiers of mines having well done their duty in that respect; but, unfortunately, their liberality is greatly prejudiced by the sectarian character of the schools provided.

EVILS OF DELEGATES.—It is a great mistake on the part of persons speaking on platforms to the working population to attempt to flatter their vanity by telling them of wrongs, of imaginary evils and oppression, instead of giving them wholesome lessons of instruction, of encouraging them to be honest, industrious, and careful. They are on all occasions crammed with complaints of legislative neglect, and no class suffer so much from this source of discontent as miners. Among their leaders there are some very good men, and a great many not sufficiently wise to be always followed. If they had the welfare of the men at heart they would on every occasion impress upon their minds the necessity of strictly observing all laws, both moral and legal, whether acknowledged or established. It is unnecessary to ask the question when past events give the answer, but is this is ever done?

ADVICE TO COAL OWNERS.—Colliery owners can hardly fail to have noticed that the public have become very much dissatisfied with colliery accidents, and that the time is fast approaching when it will urge Parliament to strict legislation. Mr. HIGSON wishes, therefore, to advise them to do all they can to lessen the loss of life, to employ competent men, to arrange the ventilation, and to see that in all places there is an adequate current of air, that the use of gunpowder where practicable be prohibited, that as few doors as possible be used in the mine, that the air be not carried too far by means of brattice, that the roads and working places be properly propped and spragged, that before shots are fired the places be well examined, and those places also on every side of them, and that proper persons of acknowledged skill and sobriety be employed as officers below ground. If these recommendations have proper attention he has no doubt there will be a great diminution of accidents, far more than by the services of a great number of additional Inspectors.

THE COAL AND IRON DISTRICTS OF BELGIUM.

Several English mining and mechanical engineers have been lately paying a visit to these districts. The visit was organised by the members of the South Staffordshire and East Worcestershire Institute of Mining and Mechanical Engineers, and the party numbered in all about 27, inclusive of the President (Mr. North), the ex-president (Mr. D. Peacock), and the hon. sec. (Mr. H. Johnson), started from Birmingham on Saturday morning, June 18, and on Monday evening reached Brussels.

Furnished by M. F. Jochams, the Inspector-General of Mines, with letters of introduction to the various engineers-in-chief and directors of mines, the party started early on Wednesday morning for Mons, and were there met by the Government Inspector for the district (M. Laguesse), who conducted them to the Belgian Coal Company's Charbonnage de l'Agrappe.

The Belgian coal field covers an area of 100 miles in length, by four to six miles in width; it is not continuous the whole length, there being slight divisions; the district about Mons is the most fully developed. There are said to be nearly 160 seams of coal, of which 120 are workable. They vary in thickness from 10 in. to 4 ft. 6 inches. The deepest pits in the world are in this country, one shaft having been sunk at the Viviers Réunis 1137 yards (nearly ¾ mile); the average depths of pits visited seemed to be about 560 yards. The coal is very much contorted, the seams shown in sections resembling very much in appearance streaked lightning. It is of such a zigzag shape that the seams in some places run vertically, or nearly so, for hundreds of yards, and we believe we are not overstepping bounds when we state that in some instances 1 acre yields as much as five would were the seams regular and horizontal. The coals are of different qualities, according to their depth; the top seams are of a gaseous nature; the next group, coking coals; then there are beds of what is called *charbon de forge*, used in the iron works; and, lastly, a hard, dry coal, useful for household purposes.

The party, having arrived at the before-mentioned colliery, proceeded to examine the surface plant. The engines, winding-apparatus, and pit frame are all enclosed in a massive building, which to persons well acquainted with mines in England had more the appearance of a large factory than a coal pit. The engines are horizontal, direct-acting, and coupled together, having two pairs of large niche rings between the cranks. The whole seemed very light to wind two two-decked cages, each carrying four tubs, from a depth of 530 yards, and yet it was quite sufficient for its work. The cages are suspended to flat hemp-ropes, and both work in the same shaft, one ascending and the other descending, so that one acts as a balance for the other. The second shaft is used for pumping water out of the pit; but they are not much inconvenienced with that troublesome element here. About fifteen of the party arrayed themselves in colliers' clothes (which consist of a suit of white canvas, similar to that worn by engine-fitters in England), much to the delight of the male and female operatives, who flocked around in scores, and entered the low cages, each carrying a safety-lamp, and were gradually lowered to the bottom of the pit. Here they entered the tubs in which the coal is drawn, and were transported, by means of horses, some hundreds of yards into the workings where the operations for getting the coal were going forward. The seam being worked is called Chauffonnoire, and at the spot visited is at an angle of about 85°. It is worked by the long wall system. A level is driven out, and its top covered with timber trees to support the gob, the coal is worked above the trees, and sent through the gob, by means of wooden troughs, into the tubs which stand below them in the level. The coal is taken clean out in this way up to another level. The Chauffonnoire seam is very soft and bituminous, and goes all to slack, but it makes excellent coke. It was a surprise to the party to find that women and girls, dressed in the same habiliments as men, were employed in the pit, loading and bringing the coal to the pit bottom. They are almost as tall and seem quite as strong as the men. All, after a thorough scrutiny, ascended to the surface, and had a good but rough wash in a pitman's cottage. When the coal is brought up out of the pit it is well washed, and then conveyed to the coke-furnaces, where it is converted to what seemed to be on examination a first-class coke. At this one colliery there are 700 persons, male and female, employed. The work goes on night and day. The working hours are from 3 A.M. to 3 P.M. for the day turn, and from 3 P.M. to 3 A.M. for the night turn. Ten hours are worked in each turn; the other two are taken up for meals. The men find their own tools, and earn about 2s. 10d. per day, the women 2s. 1d., and the children twelve years of age 1s. 3d. per day. The work is not done at so much per ton by chartermasters, as in England, but each proprietor employs managers over the workpeople, who are paid directly from him so much per day. Eight days' wages are always kept in hand to guarantee the good behaviour of the party to whom it may belong.

From an enquiry made here and elsewhere of the Government Inspectors and others, it was ascertained that the moral characters of the women engaged in the pits contrasted favourably with those of women engaged in factories and agricultural pursuits. The party having spent nearly the whole of the day at this colliery returned to their hotel, and next morning went to Charleroi, where they were met by M. Lambert, Government Inspector, who escorted them to the colliery of the Saire Madam. This is in every respect similar to the one just described, with the exception that the engines are vertical instead of horizontal, and the cages three-decked instead of two, so that six tubs are raised at a time. A remarkable piece of engineering skill has been accomplished at this pit; the shaft, which was formerly 6 ft. in diameter, has been enlarged to 13 ft. 4 in., and the pit-frame replaced by a much larger one, all in the space of two years, and without stopping the pit, night or day, for one hour.

Another shaft near here has slipped in at the bottom to the extent of thousands of tons; the large hole made has been filled up with timber, and they are now boring a fresh shaft through the solid wood. This will be an unprecedented feat of mining engineering when accomplished.

The party next visited the blast-furnaces of the Société de Ehy-le-Chateau; manager, M. Blondiau. These furnaces are well constructed, and produce 52 tons of cast-iron each in 24 hours. The iron ore used is of a red colour, and is obtained from Luxembourg and Namur. The greatest care is shown in distributing it, as well as the limestone and the coke, in the furnace; but prior to this it is broken up into small pieces, well washed, and the various proportions mixed together. The gas from the furnace top heats the air-ovens, and also the blast-engine boilers. The ironstone contains about 35 per cent. of iron. The wages paid per ton of iron produced is 4s. 4½d. The molten iron is not run into sand, as in England, but into cast-iron moulds. From this place the party proceeded to the iron works of M. Riche and Co. They are small, but extremely well laid out, and produce 700 tons of finished iron per month. This finished the day's work, and the train was taken for Liége, the principal hardware town of Belgium. On Friday morning the party went, accompanied by M. Bucloux, Government Inspector, in carriages, to the works of Sir John Cockerill and Co.

John Cockerill, afterwards Sir John, was born in England, and went to Belgium in 1817. He settled down as a machine maker in a small shop at Seraing, on the site of the present works, the largest of their kind in Belgium, we might almost say in the world. The vast extension of these works is due mainly to the enterprise of Sir John Cockerill. Their present proportions may be judged from the following statistics, translated from a paper handed to us at the works. They are engaged principally in making Bessemer steel rails, marine, locomotive, and stationary engines, bridges, railway wheels and axles, steamboats, iron-clads, &c. Nearly the whole of the materials used are raised on the estate.

The works and communications cover an area of 181 acres, 22 acres of which are occupied by buildings alone. The number of workpeople employed in 1867 was 7227, and they received for wages in the one year 264,000*l*. There are 156 steam-engines, of the collective nominal horse-power of 2843. The works can produce in one year 50 first-class locomotives, 70 steam-engines of from 4 to 1000-horse power, 1500 machines for various purposes, 2680 tons of bridge work, and 14 steamboats, taking 5000 tons of material. The offices in front of the works were formerly the Bishop's Palace. Mr. Johnson, on behalf of the Institute, in a neat speech thanked M. Pastor, one of the head managers, for showing the party over every department of the works; he, in responding, said, and he spoke for the firm—"We shall be always happy to show any such party of Englishmen over our works." This was the last place visited in the iron districts, and the party proceeded on their journey up the Rhine, returning to London on Wednesday, June 29.

In almost every instance the greatest readiness was shown to render any information. It was unanimously acknowledged that the Belgians were before us in mining engineering, especially as regards the surface plants, and that more care and skill are shown in laying out their iron works than is the case in most parts of Britain. From the observations we have made on this journey we do not feel any hesitation in giving at least some reason for the great success the Belgians have achieved as iron producers. In the first place, no expense is spared in giving full sway to the boldest engineering enterprise, and yet the most rigid economy is practised, for in no instance could it be said that there was waste of material or power in the machinery used. So much was this noticeable that engineers of repute present confessed that had they not seen it they would not have believed that the work being done could have been accomplished by the machinery used. Secondly, the minutest care is exercised in the preparing and manipulation of materials; such care, indeed, as it would almost be impossible to get the present class of English workmen to take. Thirdly, the greatest attention is paid to the comfort of the workpeople; for instance, iron works, which are naturally hot and dirty, are there cool and clean. In many instances the interiors are whitewashed; the steam cylinders, which throw out a deal of heat, were up near the roofs, as also were the boilers, or at some distance from the works. Water was continually being thrown over the whole of the works by means of leather hose, so that, although

it was the hottest time they have in Belgium, the party were enabled to walk through the works with comfort, and without experiencing inconvenience from heat as in England. We also noticed in works where more than one branch of manufacture was carried on that each department was kept distinctly to itself, and locked up as if belonging to another proprietor.

We say, then, that the success of the Belgians is mainly due to engineering skill, economy, and great care. Have they better engineers than in England? No; but we believe they have proprietors more ready to further good engineering projects and introduce improvements. We think they exercise greater economy and also care. We are glad to say that English manufacturers, in some districts at least, are becoming alive to these facts, and a revolution is being wrought.

IRON AND STEEL IN THE UNITED STATES.

Mr. M'Allister, secretary of the American Iron and Steel Association, has prepared some elaborate statistical information relative to the production of iron and steel during the past year, and from which we extract (through the *Iron Age*) the following particulars:—

The development of the pig-iron manufacture continued with increased vigour during the year 1869. The remarkable growth of this branch of business during the past few years has by no means been confined to the older iron regions, from which until recently the principal supply of iron for the whole country has been drawn. Localities that have long been known as admirably adapted to the manufacture of iron, but which it has been supposed would not be called upon to yield their stores of mineral wealth for years to come, have suddenly loomed up into importance. Several States that five years ago were compelled to purchase every pound of pig-iron for consumption, now produce many thousands of tons annually. In some of the Southern States, where before the war a few hundred tons of iron only were made in forge fires, companies are being formed for the purpose of converting their beds of coal and of pure and rich ores into the many products required by a growing diversity of interests.

PRODUCT OF PIG-IRON IN THE UNITED STATES IN 1869.

Anthracite pig-iron ..... Tons	971,150
Raw bituminous coal and coke pig-iron	553,341
Charcoal pig-iron	392,150
Total ..... Tons	1,916,641

The product in 1865 was 931,000 tons, it having more than doubled in four years. This enormous increase in the production is due, in a great measure, to the operation of a protective tariff, and the noble response of this industry to the requirements of the country overthrows some of the most plausible theories of free trade.

ROLLING-MILLS.

The production of the rail-mills for 1869 was as follows in tons of 2000 lbs.:—

Massachusetts ..... Tons	32,258
New York	79,463
Pennsylvania	319,653
Maryland	27,328
Ohio	41,837
Kentucky	7,817
Michigan	6,885
Illinois	53,261
Wisconsin	8,680
Other States	16,424
Total ..... Tons	593,586

IMPORTATION OF RAILS FROM GREAT BRITAIN.

During 1869 we imported from Great Britain 336,500 tons of rails—an increase of 36,340 tons as compared with the imports of 1868, 151,459 tons over 1867, and 216,622 tons over 1866. As we imported a few rails from other European countries, the total importation probably amounted to 345,000 tons, making, with the 593,586 tons manufactured here, a total consumption of 938,586 tons. Taking into consideration the growth of our railway system, the requirements of the country for the coming five years will, doubtless, average over a million tons per annum. Of the product of rails for 1869, 9650 tons were Bessemer steel. The erection of one or two large rail-mills is in contemplation, which will increase the capacity of our works beyond the total consumption of rails last year.

THE PRODUCT OF ROLLING-MILLS OTHER THAN RAILS

for 1869 was 642,420 tons, which may be divided about as follows:—

Merchant bar and rod ..... Tons	292,500
Sheet	36,320
Plate	78,000
Hoop	17,200
Nails and spikes	146,400
Axles, &c.	72,000

Of these manufactures we imported 120,795 tons, making a total consumption of rolled iron other than rails, in 1869, of 763,215 tons.

THE PRODUCT OF FORGES AND BLOOMERIES IN 1869

was 64,500 tons, a slight decrease as compared with the average of the past five years. Of steel of all kinds the product was 35,200 tons, of which nearly 12,000 tons was made by the Bessemer process. From the reports of the British Board of Trade we find that the exports of tin of all kinds to the United States, from the various British ports (which represents nearly all the foreign iron entering into consumption here), during the year 1869, was as follows:—

Pig-iron ..... Tons	148,383
Bar, angle, bolt, and rod	62,807
Rails of all sorts	336,500
Castings	2,076
Hoop, sheet, and boiler-plate	37,223
Other wrought-iron	9,555
Total iron	596,554
Steel	18,661

By comparing these figures with those of the previous year, we find that of pig-iron the increase in 1869 was 54 per cent.; bar, angle, bolt, and rod, 28 per cent.; railroad iron, 12 per cent.; hoops, sheet, and boiler-plate, 80 per cent.; other wrought-iron, 71 per cent.; castings, 45 per cent.: total increase of iron, 36 per cent. Of steel there was a decrease of about 3 per cent. An interesting *resumé* of the production of iron ore in the Marquette region of Lake Superior shows the total since 1856 to have been 3,274,490 tons.

After reviewing the foreign iron trade for the year, the secretary shows the estimated production of pig-iron in Great Britain to be 5,250,000 tons.

Exportation of pig and puddled iron ..... Tons 771,612
Against 552,999 tons the previous year.
Of bar, angle, bolt, and rod 357,604
Against 302,624 tons in 1868.
Of railroad iron the increase was marvellous, being..... 895,848
Against 583,488 in 1868—an increase of 312,360 tons, or 3¼ per cent.

The whole of the increased activity noted was due to the heavy demands of Russia and the United States, the former taking 252,827 tons, and the latter 300,446 tons.

THE SIEGENA SULPHUR COMPANY.—In refutation of the statement made in last week's Journal by Mr. Emil Bergmann, we are informed that a meeting of the company was held on May 27 (Mr. H. J. Trotter in the chair), at which the report and accounts to the end of 1869 were adopted; a dividend of 1062*l.* (5 per cent. for the year) was declared, and the retiring officers were re-elected. The financial position of the company being discussed, Mr. Shields submitted a plan by which the debts remaining due to the vendors might be paid off. It was resolved to submit propositions embodying the plan to a special meeting. It is proposed to accept a proposition to cancel 1000 B shares, and give 200 fully paid A shares instead; to create 500 additional A shares, including said 200; to make 500 of the unallotted A shares 10 per cent. preference shares, participating in dividends beyond 10 per cent.; to offer these shares, liable to be called up in full one month after allotment, to present shareholders; to issue 10,000*l.* worth of 8 per cent. debenture stock, redeemable at three months' notice at company's option, by payment of principal and 5 per cent. premium; to offer this debenture stock to present shareholders; and to make quorum at meetings six instead of nine. The directors reported that, in accordance with the modified terms arranged with the vendors, and explained at the last general meeting, a sum of 9238*l.* 1s. 8d. (including interest) has been paid during the year on account of purchase-money. The profit and loss account shows a balance of 3732*l.* 2s. 7d. to the credit of the year's working. Owing to the failure of pump and delay in delivery of the new one, the produce of the chief mine, Ernestus, was considerably reduced for the first half of the year, whilst the cost of keeping the mine dry by provisional means was very heavy, so that till the new pumping arrangements were completed (in August last) hardly any profits were realised. The above amount of 3732*l.* 2s. 7d. may, therefore, be considered as practically the result of six months' working only. The whole produce of the mine for some time to come is contracted for, but the directors regret that the market price continues much depressed; they, however, believe that at present prices a remunerative return on the purchase money will be obtained, and hope that before long a rise in the price of ore will produce a great increase of profit. The managing director reports that the net profits for the first four months of the present year are not less than 2000*l.* The directors have appointed Col. Wynne secretary, and Mr. A. A. Wynne, the managing director, was on July 1, 1869, engaged to continue his services at 500*l.* a year; this sum includes his remuneration as ordinary director, and also 225*l.* per annum, the amount paid to the resident English superintendent of the mines. The directors are in negociation for the renewal or continuance, on satisfactory terms, of such debentures of the company as have already fallen due.

An interesting statement by Mr. John Shields, of Durham, was laid before the meeting. With respect to the present position of the company, it appears that, notwithstanding a depression of 40 per cent. in the price of produce which occurred soon after they commenced operations, and a break down in machinery, causing a suspension of six months' working, and involving considerable outlay, a net profit has been realised between Aug., 1867, and Dec., 1869, of 10,522*l.* They have now an actual experience of two years and a half working, and certain ascertained results of a very encouraging character upon which to form an estimate of future prospects. These all tend to show that though the expectations entertained at the outset have not yet been fully realised, they have a valuable property, which must eventually yield a large return to its owners. As a set-off to these pleasing features, they have an unsatisfactory state of finances, in the fact that there still remains a debt to the vendors of 31,625*l.* with accruing interest. So long as this remains as a charge upon the property the company will be in a straitened and crippled condition, unable to develope to its full extent the practically inexhaustible supply of mineral, and also greatly hampered by the injurious competition of an adjoining and powerful company, who share with them a monopoly of sulphur produce in Central Europe, whereas if once the complete possession of the mines were secured, they would be in a position to compete on equal terms with their rivals, and in all probability to obtain a considerable advance in the price of ore.

FOREIGN MINING AND METALLURGY.

At no period of the year has the Belgian coal trade shown more animation than at present. A considerable number of contracts are being renewed, and a certain haste is displayed in their renewal, since the extraction, although carried on with vigour, cannot keep pace with the orders received. Industrials of every kind and producers of coke have readily given way to the requirements of coal workers, and an upward tendency is still apparent in prices. Coke is in considerable demand; prices vary in the Mons basin from 19s. 2d. to 1*l.* 0s. 10d. per ton for washed coke, and 16s. 10d. to 18s. 4d. per ton for unwashed coke. With reference to the apprehended want of railway plant, it may be observed that the Great Central Belgian Railway Company recently gave out an important order for trucks. It appears from official tables just prepared that in April 23,683 tons of coal were imported into the United Kingdom, of which 10,766 tons came from France and 10,307 tons from England; the Low Countries and the Zollverein furnished the rest. In April, 1869, the imports were only 18,289 tons. The imports of coal into Belgium in the first four months of this year amounted to 74,715 tons, against 68,866 tons in the corresponding period of 1869, and 95,957 tons in the corresponding period of 1868. The imports of coke into Belgium in the first four months of this year amounted to 3157 tons, against 2201 tons in the corresponding period of 1869, and 2560 tons in the corresponding period of 1868. The exports of coal from Belgium in April amounted to 302,781 tons, against 271,564 tons in April, 1869. The aggregate exports for the first four months of this year amounted to 1,188,965 tons, against 1,125,472 tons in the corresponding period of 1869, and 1,065,055 tons in the corresponding period of 1868. The quantity of coke exported from Belgium in the first four months of this year amounted to 238,194 tons, against 202,194 tons in the corresponding period of 1869, and 165,719 tons in the corresponding period of 1868. The exports of both coal and coke from Belgium will be seen to have largely increased this year, and it is expected that the augmentation will become more decided as the year advances. The Belgian iron trade maintains itself pretty well, but it is remarked that new orders do not come to hand very freely; prices, although well maintained, are consequently stationary, except as regards iron wire, in which article there has been a slight advance in price. There are complaints of a scarcity of some descriptions of workmen, and a consequent dearness of labour. Exceptionally dry weather, which has been experienced, has also had a tendency to check and curtail production. Some works have carried the price of iron from 6*l.* 12s. to 6*l.* 16s. per ton; but this latter price is far from being general, and it is considered doubtful policy to insist upon it. In the Liége basin, the various establishments are actively employed; the construction workshops especially are well supplied with orders. It appears that the imports of iron minerals into Belgium in the first four months of this year amounted in round figures to 203,000 tons, against 145,000 tons in the corresponding period of 1869. A small quantity of rails (350 tons) were imported into Belgium in the first four months of this year. The whole of the imports of iron, castings, plates, &c., into Belgium in the first four months of this year amounted to 34,517 tons, against 16,243 tons in the first four months of 1869. On the other hand, the exports of iron minerals from Belgium attained in April a total of 15,357 tons, against 15,131 tons in April, 1869; in the first four months of this year iron minerals were exported to the extent of 54,069 tons, against 43,298 tons in the corresponding period of 1869. The exports of rails from Belgium in April amounted to 12,229 tons, against 10,585 tons in April, 1869. In the first four months of this year the rail exports of Belgium were 34,823 tons, against 28,501 tons in the corresponding period of 1869. The total exports of plates from Belgium in April amounted to 2321 tons, against 1643 tons in April, 1869; and for the first four months of 1870 to 7383 tons, against 6725 tons in the corresponding period of 1869. Upon the whole, Belgium exported in April 26,012 tons of iron of every description, against 20,964 tons in April, 1869; and for the first four months of this year 77,560 tons, against 72,836 tons in the corresponding period of 1869, and 61,634 tons in the corresponding period of 1868.

The sales of gas effected by the Belgian General Company for Lighting and Heating by Gas in the nine months ending May, 1870, inclusive, amounted to 296,521,484 English cubic feet, against 278,298,206 English cubic feet in the corresponding months of 1868-9. There was thus an augmentation of 18,223,278 English cubic feet in the sales effected in 1869-70. The company has now works in operation at Arras, Bergues, Cambrai, Catana, Charleroi, Chemnitz, Dunkerque, Fourmies, Herstal, Louvain, Marchienne-au-Pont, Prague, Rimini, St. Omer, Sienna, Tournai, and Valenciennes-Anzin. The Austro-Belgian Metallurgical Company has been paying this week its second dividend for 1868-9, or 6s. per share. Other dividends are, or will shortly be, in course of payment, as follows:—Ougree Iron Manufacturing Company, 1*l.* per share; Marcinelle and Couillet Company, 12s. per share; La Haye Collieries Company, 1*l.* per share; Courcelles-Nord Collieries Company, 3*l.* per share; Val-Benoit Collieries Company, 1*l.* per share; Selessin Blast Furnaces, Iron Works, and Collieries Company, 5 per cent., or 12s. 6d. per share; Herve-Wergifosse Collieries Company, 1*l.* 16s. per share; Graissessac United Mines Company, 12s. per share.

There is not much change to report in the French iron trade; the tone of affairs is generally firm. At the same time, a certain falling off is noticed in the orders for coke-made iron for Champagne; this is due to the fact that the Champagne forges experience some difficulty in disposing of their products at Paris, where the rolling-mills of the Nord are selling at a reduction. The foundries of the Champagne group are well employed, although this is usually a dull period of the year with them. There has not been much doing in rough pig in the Champagne group; refined is quoted nominally at 5*l.* per ton (charcoal-made), and 4*l.* to 4*l.* 2s. per ton mixed. Iron, both mixed and charcoal-made, supports previous rates, and remains in as much demand as at the commencement of the season. Charcoal-made is obtainable at 8*l.* per ton. Sheets, special iron, &c., remain in good demand. In consequence of drought a certain number of works using water-power have been compelled to suspend their operations. The St. Dizier group is about to possess an additional means of production, as arrangements are being made for the construction of a blast-furnace of large size at Marnaval. A Paris merchant is stated to have purchased the Sermaize foundry; the present occupiers (MM. Breuil and Cordebar) will give up possession in the course of the current month. There is little that is new to report as to the Moselle and Meurthe groups; the foundries can scarcely keep pace with the orders on hand, and prices are decidedly remunerative. The forges are also delivering very large quantities of iron; white refining coke-made pig has made 2*l.* 18s. 4d. per ton; speckled pig, 3*l.* 0s. 10d. per ton; grey refining pig, 3*l.* 0s. 10d. per ton; casting-pig, No. 1, 4*l.* 4s.; No. 2, 4*l.*; No. 3, 3*l.* 16s.; No. 4, 3*l.* 12s.; No. 5, 3*l.* 8s. per ton. Refining pig, charcoal-made, 5*l.* 8s. per ton. The Paris iron market maintains a satisfactory aspect.

FOREIGN MINES.

ST. JOHN DEL REY.—Morro Velho, June 1: New shafts sinking during May—A shaft has been sunk 4 fms. 5 ft. 2 in.; B shaft, 5 fms. 1 ft. 4 in.: making 10 fms. 0 ft. 6 in., which is the largest monthly sinking yet effected since the rock has been entered.

GENERAL BRAZILIAN.—Capt. T. Treloar, May 30: Our operations generally are progressing satisfactorily at all points but one. That one is the shallow adit at St. Anna. At this place the ground is still flookan, and it is so soft, wet, and spongy, that though close boarding everywhere and piles are resorted to the timberwork shifts bodily; our miners can push through it, but the difficulty arises afterwards, owing mainly to the want of stability in foundation of timber work. We have reduced the size of the level hoping that, though it will have to be widened afterwards, it will be advantageous to general progress of said adit. The old adit has been pushed through the bad ground, and the deep adit has been resumed. At Itabira the shallow adit was ventilated by a second shaft, but water injuring it we deemed it more advantageous to sink a new adit shaft than resort to timber work for securing the former. The middle adit has been resumed. Explorations present very favourable indications, very good samples of gold continue to be taken, and before the end of the year gold returns will, I hope, be forthcoming. The roof of the new store is completed; timber still appearing in good quantities, and force not diminished, though the harvest is now general. Surveying for map of estate is in hand, and surveying for a new water-course is progressing apace. More stores, including horse-engine, have arrived.

PACIFIC.—Capt. Brown, June 10: Lauder Hill Mine: The 550 cross-cut south is getting out in clean ground and is letting out more water. I think we are nearing a branch or lode. I have set this end to drive 50 ft., at $13 per foot. In the 400 ft. level, west of engine-shaft, the end has been in a slide for the last 12 ft.; this has disordered the lode. We have now cut through the slide, and have a splendid lode under, from 2 to 3 ft. wide, producing fine rocks of ore, and from its appearance in the end will soon resume its former value, after getting a little distance from the slide. I have commenced to stope in the back of this level, and the lode is looking very well; I shall be able to say more about it in my next report.

BATTLE MOUNTAIN (Nevada).—W. Nancarrow, June 15: Virgin Lode: The shaft is down 36 ft. below the 37 ft. level, and we shall begin to drive this afternoon shift towards the lode, when we may have 9 or 12 ft. to cut the lode, which I hope we shall accomplish in about a week from this time. The winze below the 37 ft. level is down 27 ft., and although the lode is not so rich as at the top, still it is a real good lode for 3 feet wide; as soon as we get this winze down 36 ft. we shall begin to drive back south towards the shaft, so as to make a communication as soon as possible, and then stope the back between the winze and shaft; of this work I will write upon as we go on.—Lake Superior: We are still driving north and south on the lode at the bottom of the shaft; the lode in the north end does not improve much, but is still producing splendid stones of ore occasionally, and I shall not be surprised at any day to meet with a bunch of ore; in the south end the lode is 4 ft. wide, orey throughout, and improving every fathom we drive, and we get from here several sacks of good ore per day; the remainder goes out for what we call second class, which I hope will become available at some future time.—Troy: At the top of the Troy we are still sinking the shaft, and have some real good ore in the north end of the same; this shaft is down about 15 ft. from surface. We have also begun to open on one of our new lodes, called Hallows, and are just beginning to take out some good stones of ore, but not much work has been done yet.

RHENISH CONSOLS.—Captain Sweet, July 2: The 30 end, driving west, is presenting a more favourable appearance, small veins of lead being found running in various directions through the lode, which is letting out much water. We shall cross-cut north very shortly, for the purpose of ascertaining whether a more productive part of the lode lies in that direction. At this point the lode is probably 4 lachters wide. The sink started in the bottom of the 20, east of cross-cut, will afford 2½ tons of lead ore per lachter, but the ground is hard and watery, and consequently slow for progress. A stope in the roof of the 20, west of cross-cut, will afford 1¾ ton of lead ore per lachter. A stope in the roof of the 10, west of cross-cut, will afford 1¼ ton of lead ore per lachter.—Bliebach: North Lode: The drivage west, in the 10, is poor. We have cross-cut to the hanging-wall near this end, and found the lode 3 lachters wide, but unproductive. A stope in the roof of the 10, east of No. 3 winze, will afford 1 ton of lead ore per lachter.—Middle Lode: Stopes Nos. 1 and 2, in the roof of the 10, will each afford 1 ton of lead ore per lachter. The new shaft is being sunk 15 lachters west of the large cross-course, and will intersect the north lode a little below the 10. The most productive part of the north and middle lodes has been within 20 lachters east and west of this cross-cut. No discovery has been made in the drivage on the copper lode, in the adit level, and no lead ore has been found in costeaning.—Madonna: The lode intersected in Read's shaft is 4 ft. wide; the most orey part is 2 ft. thick, and lies against the hanging-wall, and is worth for lead 20*l.* per lachter. Under this is 1½ ft. of priary schiefer, intersected with rich spots of ore, and on the footwall are 3 or 4 inches of clay or soft flookan, so on the whole we consider the lode of a very favourable description, and just as anyone might desire. The bottom of Read's shaft and the bottom of the road shaft are at a level, consequently we shall be able to sink but little deeper with our present means. Our intention now is to drive on the course of the lode from the bottom of Read's shaft, and by the end of July more light will be thrown upon it.—Cacelia: The timber necessary for the enlargement of the old shaft will be delivered on Monday next, when operations will commence. The depth of this shaft to the shallow adit is 15 lachters, and to the deep adit 22 lachters. From the shaft to the termination of the deep adit is 450 lachters, and about 100 lachters of this was secured by timber, but a breakage having taken place in this part has caused the water to stand up 4 lachters from the bottom of the level under the shaft, and there is no way to get by it until the water be pumped out; this can be discharged at the shallow adit, and probably it will be the cheapest way to continue to do so.

PONTGIBAUD.—W. H. Rickard, July 1: Roure Mine: The 80, south of Richards's engine-shaft, yields ¾ ton of ore per fathom. The 60, south of Agnes', has entered soft, disordered ground; the lode is unproductive. The 20 north, on Virginie's lode, yields ¾ ton of ore per fathom. The same level south is poor. The adit north and south of rise yields ¾ ton of ore per fathom in each end. Our tribute pitches generally are looking pretty well throughout the mine.—La Grange: The 100 metre level, north of Nosky's shaft, yields ¾ ton of ore per fathom. The 60 north is poor. The 20 rise is in soft flookan, unproductive. Our tribute pitches have not yielded quite so much as in former months.—Mioche: The adit cross-cut east has intersected several small veins during the month's driving, but of a disordered character. At Bouzarat we have intersected two small veins of clay, in a kindly-looking rock. The 100 north has met with a slide, which has entirely destroyed the lode at this point. The winze below this level, to the east of shaft, on the lode, yields good stones of ore. The 100 south is unproductive. The 80 south yields a little saving work, of low quality. We have altogether 11 pitches, yielding very satisfactorily, on the whole.—Pranal: The 70, south of cross-cut, has entered a kindly lode, yielding ⅛ ton per fathom. The same level, south of cross-cut, is poor. The 50, north of cross-course, yields a little lead and blende. The winze behind this end yields ¼ ton of ore per fathom. The 50, south of Cohadon's winze, yields ¾ ton of ore per fathom. The tribute pitches produce fairly, on the whole, maintaining their usual yield. The samplings have amounted to 253 tons.—St. Amant: The new shaft (Susan's) is holed to the adit, and its sinking resumed below that level. The trial shaft at La Butte is down 11 metres; the lode here is disordered. We shall now drive on its course northward, under a kindly-looking back, to prove its value. At Giroux we have set men to clear the deep adit level, to prove its length, and the more effectively to examine the lode.—La Brugère: At La Planche the driving of the adit cross-cut continues in pretty favourable ground by four men. At the Moulin de Lostier we are making good progress in the adit towards the lode, which will be intersected in this month's driving. We have sent to Pontgibaud some good washed ore found in an old hutch in one of the company's houses, which was the produce of the first trial. The weight and assays are as follow:—1122 kilogrammes; assay, 63 per cent. lead, and 2·025 kilogrammes silver per ton of ore.

WEST CANADA.—F. Williams, June 14: Huron Copper Bay: In Stephens's winze, sinking below the 35, west of Palmer's shaft, the lode is not changed, and still produces 2 tons of ore per fathom. The stope to the east of this winze, below the 20, is worth fully 2½ tons of ore per fathom. The stope in the bottom of the 35, west of Palmer's, is rather poor, yielding about 2 tons of ore per fathom. The stope in the bottom of the 35, east of Bray's shaft, and west of Bartle's winze, still yields 2½ tons of ore per fathom. The stope east of Bray's shaft, and west of Carmichael's winze, below the 20, produces over 2 tons of ore per fathom. The lode in the 50, west of Palmer's, yields over 3 tons of ore per fathom. The lode in the stope below the 50, west of Palmer's, yields 2¼ tons of ore per fathom. The 60, west of shaft, has a lode giving 1¼ ton per fathom, and we may expect soon to see a change for the better. The lode in the 60, east of Bray's, yields fully 2 tons of ore per fathom. The lode in Bartle's winze, sinking below the 50, east of shaft, is not changed, and still produces 2 tons of ore per fathom for the length of the winze.—Wellington Mine: The stope east of Rowe's shaft looks well, and yields over 3 tons of ore per fathom. The stope west of shaft yields fully 2½ tons per fathom. The stope over the 35, east of Bray's engine-shaft, yields 3¼ tons of ore per fathom.

[For remainder of Foreign Mines see to-day's Journal.]

EXCHEQUER MINE (ALPINE COUNTY, CALIFORNIA).

The following is the manager's half-yearly report, from Jan. 3 to May 31:—

June 4.—Although I have endeavoured to make my monthly reports as exhaustive as possible, it may not be out of place if, in view of the near approach of the first general meeting of shareholders I place before you a short *resumé* of our operations at the mine since possession was obtained on Jan. 3. The preliminary work of clearing out the old tunnel having been completed, and your instructions being to confine myself at first to the limited system of the development referred to in Mr. Lewis Chalmers' report of Jan. 10, a hoisting chamber was excavated, having for its centre a point in the tunnel 147¼ ft. from its mouth; this chamber was 9 ft. 8 in. by 8 ft. 10 in., and 10 ft. high. From the centre of the chamber an incline shaft or winze, 6 ft. by 4 ft., was sunk on the ledge. This point (near D on the plan) was selected because from the floor of the tunnel at this spot were extracted the specimens of ruby silver ore which were sent to London and assayed by Messrs. Johnson and Matthey. At the same time work was commenced on the face of the tunnel, which was then in 317 ft.; two men working, as in the winze, night and day, and a fifth man sharpening tools and framing timbers. At 356 feet the air got so bad in the tunnel that it became necessary to adopt one of two courses—either to insert air-boxes or raise an air-shaft; the former was impracticable with 3 to 4 ft. of snow and no road between us, and the sawn timber supply. On Feb. 22, therefore, the air-shaft was commenced, is now up 88 ft., and when completed will permanently secure the ventiliation of the mine. The progress here has been unavoidably slow, as, from the state of the atmosphere and other causes, there were many days when work was impossible; but for this I should have been well on to the large chimney at C, where I shall expect to find a rich body of ore. From different points in the winze short drifts were run, and from 20,000 to 25,000 lbs. of ore extracted, 5000 lbs. of which was sent by way of experiment to the Reno Mill for reduction, and the bullion proceeds shipped to London, as to which allow me to refer you to the mill return, and my full report of April 1. When you consider that all the sorting the ore had was what it got below, where deficiency of light and the dirty state of the rock prevent an efficient separation from the earthy gangue, you will agree with me that an assay value of $139·10 per ton was a highly satisfactory result, especially when you bear in mind that the average yield of the dividend-paying Comstock is under $40. In this batch there were pieces which assayed as high as $1200 a ton. It is worthy of remark, that while from the tunnel level, when the property was offered for sale, the best ore which Mr. Lewis Chalmers could procure yielded $574·98 per ton, specimens have been taken from the shaft which go as high as $1750·50; showing conclusively the importance of getting down on the ledge as quickly as possible, and which, but for your anxiety to see bullion at an early date, I should have prosecuted to the 100 before drifting. It is seldom indeed that the same quality of ore is extracted at so shallow a level, but the beautifully defined character of the ledge, and its massive proportions (from 10 to 15 ft. wide), with its smooth walls and fine selvages, give promise that in depth we are to have a very valuable mine. No one conversant with mines, and the indications of a good ledge, has visited the Buckeye without giving expression to his admiration of its unmistakable definition, and the proofs it exhibits of its being what in miners' parlance is termed a "true fissure vein"—but all say "get down." Since the snow disappeared I have had the accesses to the mine put in good order, and without increasing my force, so as to keep as much as possible within the estimate of cost of the limited system of development before referred to. I have also almost wholly re-timbered the old tunnel, and greatly enlarged the size of the hoisting chamber, to admit a new and more powerful windlass, and the long stull pieces required for the stoping-floors. You will bear in mind that at the time of the excavation of the original hoisting chamber it was not contemplated to work the mine permanently from this shaft, but that the same was sunk more as a prospecting shaft than as the main artery from which the ore levels were to be driven, and the other mining operations carried on; now, however, I think it is possible, with our new windless and enlarged chamber, to get down, at all events with the aid of a small engine, to the 200, and I strongly recommend that the sinking should be prosecuted to that depth simultaneously with the drifting and stoping. The expense of sending ore to Reno, the charges made there for reduction, and the fact that only 80 per cent. of the assay value in silver, and only that part of the gold which is in the bullion is returned, ought to go far to justify my frequent recommendation of the purchase of the Davidson Mill; not that I mean to convey that we have yet in sight ore enough to keep a mill running, but because such an opportunity on such terms may not occur at the very time when to be without the means of reduction would be being without the means to enable you to declare an early dividend. Indeed, the freight and other charges at Reno saved by working our own ore would, were we working any quantity, soon pay a dividend, and it would not take very much of such ore as I have seen taken out of the winze to place me in a position to bring about this very desirable consummation. For instance, the small shipment we made was equal to a dividend of 11¼ per cent. on the whole capital expended here when the ore was taken out, said expense including not mining supplies and labour cost only, but travelling expenses, salaries, law, and all the expenses then disbursed—$2556·94 (see accounts for January and February). Take the item of freight alone off the bullion and you immediately reduce your dividend to 7¼ per cent. Had we had our own mill the freight and custom mill deductions would have been saved, and our bullion would have paid a dividend of 13 per cent., supposing we could work up to 95 per cent. of the fire assay, and all within two months of starting work.

My last monthly will have explained why I have not made another shipment to Reno. Should it be your wish that I repeat the experiment I shall be happy to do so. You are already aware that since the acquisition of the Acacia and Buckeye properties another 2000 ft. on the Buckeye ledge, and 90 acres of valuable woodland, have been secured, so that the value of the company's property

may be said to have been almost doubled. While having some work done on the Accacia ledge some time ago, I took from a cut close to the surface a piece of quartz, which showed ruby silver distinctly; and I do think that a main tunnel run along this ledge until it joined the Buckeye, while it would develope the Accacia, would at the same time furnish the cheapest and most effective mode of working the whole mine at a depth which can only be attained by expensive hoisting and pumping machinery—expensive at first—always expensive, and never to be compared for economical working to a deep adit or water level.—J. CHALMERS, Manager.

Original Correspondence.

COAL-CUTTING MACHINERY.

SIR,—I wish to correct a slight error that occurred in the description of my machine, in the Supplement to the Journal of June 25. Instead of each groove being being ¼ in. wide, it should have been each cutting bore ¼ in. thick, and ⅜ in. at the point, consequently each groove will be ⅜ in. wide. The cutters are not, as "Carbon" appears to understand, a pick, but a direct-acting cutter, 2 in. broad and ¼ in. thick, and ⅜ in. at the point, which bore is fixed to the piston, and goes into the inside of an open-ended cylinder on the return stroke. The objection he rose as to the expense of the small cylinders, and the trouble attending them, amounts to very little. It is the quantity of compressed air consumed that causes the expense, and seven of those cylinders can be worked with the same amount of air that would be required to drive one 8-in. cylinder, and the small cylinders are so arranged that half a dozen can be moved by one handle simultaneously. It is quite evident to me that "Carbon's" experience with a pick coal-cutting machine is only very slight, otherwise he would not say "the coal removed from the space, or groove, in which the machine, or pick, acts is not in a saleable state," or that the space is cleared by each blow, so that full effect is given by the next and each successive blow. There is certainly a few splinters from the first or second blow at the commencement of each cut, but the remainder is as fine as powder, and in no case, I believe, ever sent to bank.

Waterloo Main Colliery, Leeds, July 6. J. ROTHERY.

ROAD LOCOMOTION OF THE FUTURE.

SIR,—I have read with great interest the admirable leading article, which appeared in last week's Journal, on the Road Locomotion of the Future, and cannot help thinking that the majority, if not all, of your readers will agree with the opinion you have there expressed, and that it will be realised before many years have passed away.

Tramways appear to be one of the popular schemes of the day, and the deep interest taken in them by the press, the public, and the Legislature, coupled with your remarks of Saturday last, induce me to trespass on your valuable space to say that the company to whom I have the honour to act as secretary, by not pledging itself to any particular system, but wishing to adopt that which will not in any way interfere or impede the ordinary traffic on the roads, has had submitted to them for their consideration very many systems of trams, cars, and locomotives, and that I shall have great pleasure in showing these designs to any of your subscribers who may wish to inspect them if they will favour me by calling at the offices of the company.

In conclusion, allow me to state that it has been almost the unanimous opinion of many engineers and other gentlemen who have inspected these plans that the "on and off" system, more particularly that invented by Eastman or Adams, which you have advocated in your columns, is the one best adapted to our streets and roads.

JAMES W. THOMAS,
Secretary to the Southall, Ealing, and Shepherd's Bush Tram Railway Company.
1, *Circus-place, Finsbury, London, July* 6.

EBERHARDT AND AURORA MINING COMPANY.

SIR,—In last week's Journal is a letter signed "P.," commenting upon the assumed profits to be derived from crushing ores by the Eberhardt and Aurora Mining Company. Your correspondent omits to refer to the fact that the mills to be erected by this company are to crush 80 tons a day (dry crushing). For your guidance I have been furnished with the *profits* of a neighbour's crushing for two months, which are $69,000, and this with a mill working only 40 tons a day. Had the owners of the lode in question mills equal to crushing 80 tons a day their profits for two months would have been $138,000, which dwarfs the assertion of your correspondent, who says the returns for the past quarter for the entire White Pine district did not equal $114,000 net. The words imputed to the Chairman by "P." were mine. Your correspondent conceals his name, I prefer giving mine.—*Copthall-court, Throgmorton-street.* F. T. HAGGARD.

THE METALS AND THEIR ORES—No. VIII.

SIR,—In this and the following paper some of the most frequent combinations betwixt the metallic and non-metallic elements will be described.

SULPHUR.—This well-known substance is a yellow, brittle, inflammable solid, insoluble in water, melts at 232° Fahr., and has a density of 2·0. Native sulphur is largely produced from most volcanic regions. It is obtained from the volcanic sublimate called Solfatara, near Naples, from the crater of Vulcano, on the Lipari Islands, and from Etna and Vesuvius. Sulphur is also produced in Iceland, Java, Hawaii, Teneriffe, Guadaloupe, New Zealand, and the islands of the Pacific. A large proportion of the native sulphur employed in Great Britain is obtained from Sicily, and is extensively used for bleaching, and in the manufacture of gunpowder, sulphuric acid, and other chemical products.

This element has a strong affinity for and unites with the metals, the result of the combination being the production of both soluble and insoluble sulphides, frequently possessing metallic lustre, and which by exposure to the action of heat, air, and moisture, are occasionally decomposed, and formed into soluble, or partly soluble, sulphates. Very few only of the sulphides are completely reduced to their metallic state by heat alone, and these are chiefly amongst the noble metals. The native sulphides are plentifully distributed, the most important and abundant being the sulphides of antimony, arsenic, cadmium, copper (as copper pyrites), iron (as iron pyrites), lead (as galena), mercury (as cinnabar), molybednum, silver (as silver glance), and zinc (as blende). The sulphides of bismuth, cobalt, manganese, nickel, and tin are also found naturally, but they are less frequently met with than those just enumerated. It often occurs that the commoner sulphides are intimately commingled and closely intermixed together in the vein—for example, zinc and copper, lead and zinc; copper, lead, and zinc; silver and lead, with traces of gold; iron and manganese, iron and copper, cobalt and nickel, or arsenic, cobalt, and nickel are often found associated in the same samples of vein stuff, and it then becomes a troublesome, but necessary, operation on the part of the miner to separate, and by washing to cleanse and classify each for sale.

SELENIUM.—A rare non-metallic element, sometimes found with sulphur, which it closely resembles, red-brown in colour, insoluble in water, specific gravity 4·5, burns with a blue flame, and exhales a disagreeable odour, resembling decayed horseradish, by which heated seleniurets, or selenides, may generally be known. The action of selenium upon the metals is very similar to that of sulphur. The selenides are, however, less numerously met with than the sulphides. The principal seleniurets are those of cobalt, copper, lead, mercury, silver, and zinc; they are, however, very rarely found, and usually in small quantities only.

IODINE.—An element chiefly obtained from sea-water and marine plants, in which it is found combined with sodium and magnesium. It is blue-black in colour, is volatilised at 347° Fahr., and gives off a beautiful violet-coloured vapour, having an odour something like chlorine. It crystallises in shining plates, is soluble in 700 parts of water, and has a density of 4·9. It is extensively used in medicine. The element iodine unites with some of the metals, forming iodides. They are not naturally a numerous group, however, the chief of those found native being the yellow-white iodide of silver, found chiefly in Mexico, Chile, and Spain, the brownish-red oxide of mercury in Mexico, and the iodide of zinc in Silesia.

CHLORINE.—A yellowish-green elementary gas, having a very peculiar and pungent smell. It is two and a half times the weight of air. It cannot be respired, and is not a supporter of ordinary combustion. If, however, metals in a finely divided state, are thrown into chlorine gas, the combination is so energetic as to cause them to take fire in it spontaneously. Chlorine destroys or bleaches vegetable colours, and is a powerful disinfectant. The metals combine with this element, thus producing chlorides. By the action of heat metallic chlorides are fused, some of them are volatile, and the chlorides of antimony, arsenic, mercury, and tin suffer no change, even by sublimation. Only of a few of the chlorides, and notably gold and platinum, are reduced by heat alone to the metallic state.

The native chlorides are not a numerous class, the chief being those of copper, lead, mercury, and silver. E. GLEDHILL.

Mining Offices, Shrewsbury, July 5.

[For remainder of Original Correspondence, see this day's Journal.]

ROYAL SCHOOL OF MINES.

At a meeting of the Council, held in Jermyn-street on July 2, the undermentioned gentlemen, having passed the requisite examinations, received the title of "Associate of the Royal School of Mines."

Metallurgical Division.—Messrs. Wm. Gowland, Dillon, A. Liversidge, A. W. Bickerton, F. W. Bayley, and J. Jones.

Mining Division.—Messrs. Wm. Gowland, Archd. Liversidge, and H. J. Renwicke.

Geological Division.—Mr. W. Johnson Sollas.

The following *Medals* and *Scholarships* were also awarded:—To third year's students, the De la Beche Medal and prize of books for Mining, to Wm. Gowland. To second year's students, H.R.H. the Duke of Cornwall's Scholarship of 30*l.* for two years, to P. C. Gilchrist. The Royal Scholarship of 25*l.* for one year, to R. R. Atkinson. Sir Roderick Murchison's Medal and prize of books, for Geology, to P. C. Gilchrist. To first year's students a Royal Scholarship of 15*l.* to—1, W. H. Greenwood; 2, F. C. Milford.

THE INSTITUTION OF CIVIL ENGINEERS.

PREMIUMS—SESSION 1869-70.

The Council of the Institution of Civil Engineers have awarded the following premiums:—

A Telford Medal, and a Telford Premium, in Books, to EDWARD DOBSON, Assoc. Inst. C.E., for his paper "On the Public Works of the Province of Canterbury, New Zealand."

A Watt Medal, and a Telford Premium, in Books, to R. PRICE WILLIAMS, M. Inst. C.E.,* for his paper "On the Maintenance and Renewal of Railway Rolling Stock."

A Watt Medal, and a Telford Premium, in Books, to JOHN THORNHILL HARRISON, M. Inst. C.E.,* for his paper "On the Statistics of Railway Income and Expenditure, and their Bearing on Future Railway Policy and Management."

A Telford Medal, and a Telford Premium, in Books, to THOMAS SOPWITH, Jun., M. Inst. C.E., for his paper "On the Dressing of Lead Ores."

A Telford Medal, and a Telford Premium, in Books, to JAMES NICHOLAS DOUGLASS, M. Inst. C.E., for his paper "On the Wolf Rock Lighthouse."

A Watt Medal, and a Telford Premium, in Books, to GEORGE BERKELEY, M. Inst. C.E., for his "Observations on the Strength of Iron and Steel, and on the Design of Parts of Structures which consist of those Materials."

A Watt Medal, and a Telford Premium, in Books (to consist of the second series of the Minutes of Proceedings, vols. xxi. to xxx. inclusive), to ROBERT BRIGGS, of Philadelphia, U.S., for his paper "On the Conditions and the Limits which govern the Proportions of Rotary Fans."

A Watt Medal, and a Telford Premium, in Books, to EDWARD ALFRED COWPER, M. Inst. C.E., for his paper "On Recent Improvements in Regenerative Hot-Blast Stoves for Blast-Furnaces."

A Telford Premium, in Books, to JOHN GRANTHAM, M. Inst. C.E., for his paper "On Ocean Steam Navigation, with a View to its Further Development."

A Telford Premium, in Books, to DANIEL MAKINSON FOX, M. Inst. C.E., for his "Description of the Line and Works of the Sa o Paulo Railway, in the Empire of Brazil."

The Manby Premium, in Books, to EMERSON BAINBRIDGE, Stud. Inst. C.E., for his paper "On Coal Mining in Deep Workings."

The Council have likewise awarded the following prizes to *Students* of the Institution:—

A Miller Prize to ROBERT WILLIAM PEREGRINE BIRCH, Stud. Inst. C.E., for his paper "On the Disposal of Sewage."

A Miller Prize to HENRY THOMAS MUNDAY, Stud. Inst. C.E., for his paper "On the Present and the Future of Civil Engineering."

A Miller Prize to WILLIAM WALTON WILLIAMS, Jun., Stud. Inst. C.E., for his paper "On Roads and Steam Rollers."

A Miller Prize to SIDNEY PRESTON, Stud. Inst. C.E., for his paper "On the Manufacture and the Uses of Portland Cement."

A Miller Prize to EDWARD BAZALGETTE, Stud. Inst. C.E., for his paper "On Underpinning and Making Good the Foundations of the Irongate Steam Wharf, St. Katherine's, London."

A Miller Prize to JOSIAH HARDING, Stud. Inst. C.E., for his paper "On the Widening of the Liverpool and Manchester Railway between Liverpool and Huyton, and on the Construction of a Branch Line to St. Helen's.

A Miller Prize to the Hon. PHILIP JAMES STANHOPE, Stud. Inst. C.E., for his paper "On the Metropolitan District Railway."

* Have previously received Telford Medals.

MINING IN SHROPSHIRE—ANCIENT AND MODERN.

The members of the Severn Valley Naturalists' Field Club had a two days' meeting last week, which proved unusually successful, both as regards the attendance and the number of places and objects of interest which fell along the line of the selected route. When the party arrived at the Gravels Mine they were met by Messrs. T. Wright and R. J. More. The various operations of crushing and washing the ore were explained by the captain of the mine and other workmen, and, illustrated as their descriptions were by the actual execution of the work, they were exceedingly interesting. Not one of the least interesting of these processes, and certainly not one of the least profitable to the proprietors of the mine, is the removing of what is termed the "slime ore" from the water and refuse. A comparatively short time ago the water in which the lead was washed was allowed to flow away as useless when all the lead was obtained from it that could be obtained by the ordinary mode of washing. Now, by an exceedingly ingenious piece of machinery, what used to be thrown away as mud is re-washed, and made to deposit itself in the form of a flat cone. As the deposit commences in the central or higher part of the cone the lighter material is carried away by a gently flowing current of water, which is supplied with the mud at the apex, and the heavier material, or the lead, being too ponderous to be borne away by the tiny stream, collects around the centre, where it is comparatively free from all foreign matter. The lead thus obtained, which is in a state of very fine powder, amounts to many tons per month, and is worth about 16*l.* per ton. Formerly, as already stated, this valuable source of profit flowed away altogether, poisoned the brooks, and killed the fish for miles. Now it helps, in no small degree, to swell the dividends of the proprietors. Boards of conservators and lead mining companies are somewhat antagonistic in their operations now, but when science takes another step onward, and shows how to remove, at a small cost, the very small percentage of lead which is now left to pollute our streams, then all grounds for antagonism will have vanished, and mining companies will find a still further augmentation of their annual income. After being properly washed the ore is piled in heaps in a covered building, and on Tuesday many scores of tons were to be seen, all of which, it was understood, had been ordered by smelters beforehand. The mine is exceedingly rich in ore, and the ore, yielding as it does a high percentage of metal, realises the highest prices in the market. After a stay of about an hour in the works the party climed to the summit of the Shelve, a hill close at hand, and did what the most "visioned poet" and enthusiastic naturalist must alike do—"refreshed."

After luncheon, the party descended to a point where a number of deep cuttings, the remains of Roman mining operations, extend up the side of the hill. At this point, Mr. Thomas Wright, at the request of the secretary, Mr. Cooper, made a few observations. He said they were at that time in the middle of a district which was one of the greatest mining districts in the island. The Romans came to that part of the country to get their lead. Their iron they procured in Wales, and there were remains of their copper mines at Llanymynech. It was well known that the Romans set great value upon this province for its metals, and no doubt they visited that part of the country at an early period to get possession of its valuable mineral treasures. Around that part of the country there were not only remains of Roman mines, but of Roman roads, so that there must have been continual communications between one point and another, and they had, too, at no great distance, the remains of by far the largest Roman city in Great Britain, Uriconium. Among the relics of that city which had been discovered were numerous articles of metal, particularly of lead, of which the ore had probably been dug in that neighbourhood. When the Romans came first to that part of the island, he had no doubt the minerals were found untouched. They found the veins of lead cropping up to the surface, and they followed them up the hill, and dug them out along the surface. Where the metal was more plentiful shafts were dug, and these, with other excavations, were perfectly apparent. Of course, in all such operations the Romans were very imperfect workmen, as compared with miners of the present day. Their great difficulty was that they had no machines to get the water out of the mines when they went to any depth, consequently they did not sink deep, and had left all the mineral wealth below for the miners of the present day, who took every advantage of the imperfections of their predecessors.

Miners of the present day had gunpowder for blasting, the Romans had not. They (the Roman miners) adopted another plan. They made a fire against a rock, heated it as hot as possible, then threw water over it, and so cracked the stone and got out the ore. Roman miners used tallow candles, as do the miners of the present day, and pieces of them were often found in Roman mines. Some were to be seen at Mr. More's, at Linley. They were sometimes found by the workmen, who had taken them home, and, thinking them ordinary candles, had made fruitless efforts to light them. The tallow had now gone quite hard, and altogether changed in its character. Among the rubbish in these ruins were also found curious oak shovels, and some of them would also be seen at Linley. There was another fact of some interest which might be mentioned, in relation to the subject. Usually the ores were smelted at the mines, but he was not aware that any remains of a smelting-house had been found there. A short distance off, however, near Linley, a "pig" of lead had been found, bearing the name of the Roman Emperor Adrian, and it had, no doubt, been dropped at the place where it was found, the smelting having, he believed, being done at Churchstoke. This "pig" would also be found at Mr. More's. Near the entrance to Linley were the remains of an extensive Roman villa, which had been discovered by the late Rev. T. F. More, and he (Mr. Wright) was of opinion that the person who had resided in it was the head officer over that mining district. Mr. Wright concluded by expressing a hope that the remarks he had made would enable those present to understand more fully the ancient workings that lay around them.

Mr. Cooper, the honorary secretary of the club, then expressed the thanks of the members and friends to Mr. Wright for his address, and that gentleman was very warmly cheered.

The party then divided itself into two sections, one proceeding to Corndon and the other to Linley. The latter under the guidance of Mr. R. J. More and Mr. T. Wright.

PRICES OF MATERIALS,

As charged at the PROVIDENCE MINES during the following months:—

Description.		Feb.	March.	April.
Common iron	per cwt.	—	9s. 0d.	—
Hoop ditto	,,	13s. 6d.	13 6	12s. 3d.
Best cast steel	,,	56 0	50 0	—
6-in. patent nails	,,	19 0	—	—
5-in. ditto	,,	19 0	—	—
4 in. ditto	,,	20 0	—	—
3½-in. ditto	,,	20 3	—	—
Iron shovels	,,	28 0	—	—
Steel-point ditto	,,	48 0	—	—
Hammered iron kibbles	,,	—	—	20 0
White lead	,,	—	23 0	—
Leather	per lb.	1 6	—	—
Baltic timber	per foot	—	1 1	—
Norway ditto	,,	0 8	0 9	0 8
M. C. coals (contract)	per ton	11 6	12 6	11 3
Best candles*	per doz.	5 9	5 9	5 6
Tallow*	per cwt.	49 6	49 6	—
Best grease*	,,	—	12 0	—
Oil*	per gallon	—	4 3	—
Powder*	per 100 lbs.	33 0	33 0	33 0
Safety fuse*	per coil	0 4	0 4	0 4
Rope*	,,	—	42 0	—
Hemp*	per lb.	—	—	0 5
White yarn	,,	—	0 5¼	0 5¼

* Delivered free of carriage.

CORNISH PUMPING ENGINES.—The number of pumping-engines reported for May is 18. They have consumed 1550 tons of coal, and lifted 11·6 million tons of water 10 fms. high. The average duty of the whole is, therefore, 50,400,000 lbs., lifted 1 ft. high, by the consumption of 112 lbs. of coal. The following engines have exceeded the average duty:—

Cargoll Mines—Michell's 72 in.	Millions	67·1
Dolcoath—85 in.		59·1
North Wheal Crofty—Trevenson's 80 in.		63·9
South Wheal Frances—Marriott's 75 in.		54·6
West Chiverton—Hawke's 80 in.		56·5
West Wheal Seton—Harvey's 85 in.		70·0
Wheal Seton—Tilly's 70 in.		54·3
Wheal Seton—Tregonning's 70 in.		66·6

MOTIVE POWER ENGINES.—The invention of Mr. H. C. LOBNITZ, Renfrew, N.B., consists in placing high-pressure cylinders at an angle to the low-pressure cylinder, and connecting their pistons to one crank pin, and in engines where the cylinders oscillate the high and low-pressure cylinders are separate, and placed also at an angle to each other (in place of being united and parallel as hitherto), but the pistons of which are connected to one crank pin. By means of the arrangements hereinbefore set forth, the dead points of the crank are as effectually overcome as in combined engines hitherto made with four cylinders—that is to say, with two high-pressure cylinders and two low-pressure cylinders. The exhaust or eduction passage between the cylinders is made as short and of as small capacity as is compatible for educing the steam from the high-pressure cylinder, and the use of a steam jacket, chamber, or reservoir for the steam escaping from the high-pressure cylinder is avoided, so that by this arrangement the steam acts in the low-pressure cylinder as rapidly as possible, as it exhausts from the high-pressure cylinder.

COAL MINES.—The invention of Mr. P. WALKER, Warrington, consists in setting fire to or exploding the gas or gases at frequent intervals, and for this purpose the inventor employs a current or currents of electricity, magnetism, or galvanism, which is or are conveyed into the interior of the mine by means of conducting wires, in manner as will be well understood, in various parts of the working and other parts of the mine wherein the aforesaid gas or gases have been found to accumulate. The inventor causes the contact of the conducting wire or wires to be broken, so that when a sufficiently strong current, as, for example, of galvanism, is passed through the said wire or wires, heat shall be generated sufficient to fire or explode the air contained in the said parts of the mine. Patent completed.

STEAM-HAMMERS.—The invention of Mr. G. D. EDMESTON, Preston, consists in jointing one end of a lever on a fulcrum on the frame (or on a pin or eccentric, which can be moved as hereinafter explained), and arranging the other end of the lever to enter a slot in the hammer or tup, or in otherwise connecting it therewith, so that the said lever will partake of the vertical up and down movements of the tup or hammer. At about the middle and on one side of the lever a fulcrum pin is fixed, and another lever of the first order is mounted thereon, one end of which is weighted, and the other or lighter end comes about opposite to the fulcrum of the first-named lever (which is connected with the hammer or tup), and is there jointed with a rod that transmits motion to the slide valve.

IRON AND STEEL.—The invention of Mr. W. GORMAN, Glasgow, consists in the reducing, or partial reducing, of iron carbonate ores in retorts, heated externally, and excluding atmospheric air, and the treating of any iron ores in such retorts when arranged and worked and combined with other parts. Also in the use of carbonic oxide, formed from carbonic acid, derived from the ores, and flux themselves as an agent for reducing ores, or for producing heat in the same or other furnaces. Also in the heating or coking of carbonaceous ores, or other carbonaceous substances in retorts or chambers heated by waste heat.

MOTIVE-POWER.—J. L. R. BOUTROUILLE and J. B. HENNE, Roisel, France.—Liquid sulphurous acid is to be evaporated in a generator, which is immersed or partly immersed in a boiler heated by petroleum burners or otherwise. The hot water heats the sulphurous acid to a temperature of from 125° to 140°, which is maintained, a thermometer being fitted for this purpose. The vaporised acid issues from the generator by a pipe, which leads it to an ordinary valve box. The acid then passes by orifices or ports into a cylinder, and produces its useful effect upon the piston therein, and thus puts in motion the mechanism connected therewith—the connecting rod, crank, fly-wheel, eccentric, and other parts; the eccentric is jointed to a lever, which at its upper part actuates the slide valve, and at its lower part works a suction and force pump.

The Scotia, from New York, has brought over a further remittance of $13,000 in bar silver, of which $10,000 is from the South Aurora, and $3000 from the Eberhardt Mines.

GOLD MINING IN CALIFORNIA.—According to the Californian papers the annual production of gold in that State has in eight years' time fallen from 6,400,000*l.* to 4,600,000*l.*, and has now become an ordinary occupation, yielding no more than an average remuneration, and not so much as many other trades. The business, it is stated, has passed under the control of large capitalists, and the miners receive wages of 16s. a day. The capitalists assert that they are unable to keep the mines in operation at these wages, while the miners are resisting reduction; as a consequence "many of the mines are closed, and those still in operation do not offer any prospect of reasonable returns."

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